

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME:

Pseudanophthalmus caecus Krekeler
Pseudanophthalmus frigidus Barr
Pseudanophthalmus inquisitor Barr
Pseudanophthalmus major Krekeler
Pseudanophthalmus parvus Krekeler
Pseudanophthalmus troglodytes Krekeler

COMMON NAME:

Clifton Cave beetle
Icebox Cave beetle
Inquirer cave beetle
Beaver Cave beetle
Tatum Cave beetle
Louisville cave beetle

LEAD REGION: 4

INFORMATION CURRENT AS OF: October 2005

STATUS/ACTION:

- ☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status
- ☐ New candidate
- ☒ Continuing candidate
- ☐ Non-petitioned
- ☒ Petitioned - Date petition received: May 11, 2004
- ☐ 90-day positive - FR date:
- ☐ 12-month warranted but precluded - FR date:
- ☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

- a. Is listing warranted (if yes, see summary of threats below)? yes
- b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes
- c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing

determinations, emergency listing evaluations and determinations, and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov/>).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): October 30, 2001

___ Candidate removal: Former LP: ___

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Insects Carabidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:

Pseudanophthalmus caecus, Clifton Cave beetle - Kentucky

Pseudanophthalmus frigidus, Icebox Cave beetle - Kentucky

Pseudanophthalmus inquisitor, Inquirer cave beetle - Tennessee

Pseudanophthalmus major, Beaver Cave beetle - Kentucky

Pseudanophthalmus parvus, Tatum Cave beetle - Kentucky

Pseudanophthalmus troglodytes, Louisville cave beetle - Kentucky

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:

Pseudanophthalmus caecus, Clifton Cave beetle - Kentucky

Pseudanophthalmus frigidus, Icebox Cave beetle - Kentucky

Pseudanophthalmus inquisitor, Inquirer cave beetle - Tennessee

Pseudanophthalmus major, Beaver Cave beetle - Kentucky

Pseudanophthalmus parvus, Tatum Cave beetle - Kentucky

Pseudanophthalmus troglodytes, Louisville cave beetle – Kentucky

LAND OWNERSHIP: All but four of the caves supporting these species are privately owned.

LEAD REGION CONTACT: Richard Gooch, 404/679-7124

LEAD FIELD OFFICE CONTACT: Asheville, North Carolina Field Office, Robert R. Currie, 828/258-3939, extension 224

BIOLOGICAL INFORMATION:

Cave beetles in the genus Pseudanophthalmus are fairly small, eyeless, reddish-brown insects. Like most other insects, they have six legs and a body that consists of a head, thorax, and abdomen. Body length is generally from 3.0 to 8.0 millimeters (mm) (0.12 to 0.32 inches), depending upon the species. The different species within the genus are differentiated by differences in the shape and size of the various body parts, especially the shape of the male appendages used during reproduction. Barr (1996) states that there are approximately 255 species in the genus Pseudanophthalmus. The insect genus Pseudanophthalmus is in the predatory ground beetle family Carabidae. Most members of this genus are cave dependent (troglobites) and are not found outside the cave environment. All are predatory and feed upon small cave invertebrates such as spiders, mites, millipedes, and diplurans, while the larger Pseudanophthalmus species also feed on cave cricket eggs (Barr 1996). Members of this genus vary in rarity from fairly common, widespread species that are found in many caves to species that are extremely rare and restricted to only one cave or, at most, two caves.

Little detailed life history information is available for the rarest of the cave beetles that are considered here, but the generalized summary that follows is accurate for the more common and more easily studied species and is believed to also apply to the rarer species (Barr 1998). Cave beetles copulate in the fall, and the eggs are deposited in the cave soil during late fall. The eggs hatch and larvae appear in late fall through early winter. Pupation occurs in late winter to early summer with the adult beetles emerging in early summer (Barr 1996).

The limestone caves in which these cave beetles are found provide a unique and fragile environment that supports a variety of species that have evolved to survive and reproduce under the demanding conditions found in cave ecosystems. No photosynthesis takes place within the dark zone of a cave. Therefore, all organisms that are adapted to life within a cave are dependent upon energy from the surface. This energy can be in the form of leaf litter, woody debris or small bits of organic matter that is washed or falls into the cave, or guano deposited by cave-dependent bats that feed on the surface and return to the cave to roost (Barr 1996).

Pseudanophthalmus caecus, the Clifton Cave beetle, was described by Krekeler (1973) based upon material collected by T.C. Barr in 1963. The cave supporting this species is

near Versailles, Woodford County, Kentucky. Soon after the species was first collected, the entrance to the cave was enclosed due to road construction. Other caves in the vicinity of Clifton Cave were surveyed for the species during a 1995-1996 survey for the species. Most contained other species of Pseudanophthalmus, but only one additional site was found for the Clifton Cave beetle. Four specimens were found in a very small, 30 foot (9 meters) long cave about 1 mile (1.61 kilometers) from Clifton Cave. It can not be determined at this time if the species still occurs in Clifton Cave or if the species has been extirpated from its type locality by the closure of the cave entrance.

Pseudanophthalmus frigidus, the Icebox Cave beetle, was described by Barr (1981) based upon two specimens he collected from Icebox Cave, Bell County, Kentucky. Despite searches of caves in the vicinity of this cave and several later visits to Icebox Cave, no additional specimens of Icebox Cave beetle have been found.

Pseudanophthalmus inquisitor, the inquirer cave beetle, was described by Barr (1980) from specimens collected in Sheals's Cave, Clay County, Tennessee. The species is not known from any other caves. During a 1997 survey of the cave, Barr (1998) observed 3 specimens of inquirer cave beetle.

Pseudanophthalmus major, the Beaver Cave beetle, was described by Krekeler (1973) from 3 specimens collected by T.C. Barr and J.R. Holsinger in 1966, from Beaver Cave, Harrison County, Kentucky. No additional caves that could provide habitat for the Beaver Cave beetle were found during a 1996 survey of Beaver Cave and the surrounding area. One specimen of the species was observed in Beaver Cave during this survey (Barr 1996). The species was also observed in the cave during a survey conducted in 2005 by the Kentucky State Nature Preserves Commission (KSNPC).

Pseudanophthalmus parvus, the Tatum Cave beetle, was described by Krekeler (1973) from material collected from Tatum Cave, Marion County, Kentucky. Despite searches in 1980 and in 1996, the species has not been observed in Tatum Cave since 1965. There are no other known caves in the vicinity of Tatum Cave that could support the species.

Pseudanophthalmus troglodytes, the Louisville cave beetle, was described by Krekeler (1973) from specimens collected from Oxmoor Cave, Jefferson County, Kentucky. During 1994, surveys of other caves that could potentially support the species were conducted by J. Lewis (Barr 1996). Ten caves were surveyed and the species was found in only one additional cave (Eleven Jones Cave).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

All of these six cave beetles (Clifton Cave beetle, Icebox Cave beetle, Inquirer cave beetle, Beaver Cave beetle, Tatum Cave beetle, and Louisville Cave beetle) are currently known from only one cave.

Their limited distributions make these species vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction (Barr 1996). Caves and the species that are completely dependent upon them (troglobites) receive the energy that forms the basis of the cave food chain from outside the cave. This energy can be in the form of bat guano deposited by cave-dependent bats, large or small woody debris washed or blown into the cave, or tiny bits of organic matter that is carried into the cave by water through small cracks in the rocks overlaying the cave (Barr 1996). Activities such as industrial, residential, commercial, or highway construction can, if not planned in a manner to protect caves, directly destroy caves or result in severe modification of the natural processes that maintain the sensitive biological systems they support. Pollution and chemical contamination can, under certain circumstances, result in the complete destruction of the unique life found within a cave impacted by these factors. Vandalism and trash dumping have affected some of the sites and all of the caves are vulnerable to these activities. Loss or reduction of the supply of energy can result in the loss or severe reduction of cave beetle populations (Barr 1996).

Many of these fragile caves have been adversely impacted. The entrance to Clifton Cave was enclosed due to road construction. Icebox Cave is within the city limits of Pineville and is frequently visited, heavily vandalized, and contains a lot of trash. Sheals's Cave is in a rapidly expanding urban area and indirect impacts, such as chemicals or other pollution, could significantly impact both the cave and the species the cave supports. A sinkhole that drains into the cave system is located away from the protected entrance and is near a highway (Barr 1998). Chemical and other spills could easily enter the cave system through this sinkhole entrance. Alterations in the landscape associated with an expanding urban area are expected and could negatively affect the cave system that contains the inquirer cave beetle. Beaver Cave is well known in the local area and receives frequent visitation. Vandalism and the accumulation of trash in the cave has increased in recent years. Barr (1996) states that this has probably resulted in a decrease in the habitat available to the Beaver Cave beetle. Tatum Cave has three natural entrances and an additional entrance has been created in order to use the cave as a water supply (Barr 1996). This additional entrance has modified air flow within the cave and may have seriously impacted the Tatum Cave beetle population. Oxmoor and Eleven Jones Caves are both within the Louisville metropolitan area. Urban expansion has resulted in the loss of Oxmoor Cave. In about 1990, the entrance to the cave was bulldozed shut and a residential subdivision was built over the area. Eleven Jones Cave is a small cave that sometimes has high levels of carbon dioxide (Barr 1996). These elevated carbon dioxide levels may be related to high levels of pollution in the water entering the cave. Dependence upon the surface makes caves and the life that is found within them vulnerable to actions that take place well outside and away from the cave. Protection of caves and cave dependent species must include both the physical environment in which the species are found and the surface components that provide the energy and clean water needed for survival.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

All of these cave beetles occur at only one location. Most populations are extremely small and careless collecting, whether for scientific or other purposes, could adversely affect them. These species have no known commercial value, however, the caves in which these species occur may be used for recreational purposes by spelunkers and by passive recreationists.

C. Disease or predation.

Disease or predation is not known to be a significant problem for any of these species. However, since each species appears to exist with low numbers of individuals, mortality via either of these two factors may have a significant, negative impact on recruitment and long-term survival.

D. The inadequacy of existing regulatory mechanisms.

These species are not protected under Kentucky or Tennessee state law.

E. Other natural or manmade factors affecting its continued existence.

Populations of each of these cave beetle species are restricted to a single cave system and are generally believed to be represented by small numbers of individuals. These characteristics make them extremely vulnerable to extirpation from (1) intentional or accidental toxic chemical spills, (2) non-point source pollutants, (3) alteration or closure of cave entrances that disrupt the natural flow of organic matter and can alter natural temperature and hydrologic regimes, and (4) excessive human disturbance (e.g., trampling, vandalism, building fires). Their small size and cryptic behavior also make them difficult to study, further complicating attempts at conservation. Small population sizes for these species limit the natural interchange of genetic material within each population. Unfortunately, it is possible that some of these beetle populations are below the effective population size required to maintain long-term genetic and population viability.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Kentucky Department of Fish and Wildlife Resources (KDFWR) in cooperation with the Service funded a status survey for the rarer cave beetles that occur in Kentucky. A part of this survey included identification of owners of the caves supporting these species. In gathering the land ownership information needed for the final report on this cooperatively funded project (Barr 1996), the landowners were made aware of the presence of the rare cave beetles within caves on their land. In general, these landowners were supportive of protecting these rare species. The Service's Kentucky Field Office is working with the owner of Beaver Cave and anticipates developing a Cooperative Management Agreement to protect the site in FY06. The Tennessee Wildlife Resources Agency (TWRA) and the Service entered into a similar agreement for the rare cave

beetles of Tennessee. An interim progress report for this effort (Barr 1998) stated that the owner of Sheals's Cave in Tennessee (site for Inquirer cave beetle) was contacted and seemed to be interested in providing protection for the cave. In 2005 The Nature Conservancy, TWRA, the Service and the landowner entered into a cooperative management agreement to protect Sheal's Cave.

Most of the owners of the sites on which these cave beetle caves occur were contacted by Barr or those assisting him with survey activities to determine the status of these species. Most owners were pleased to learn of the presence of a rare species within their caves and are expected to be willing to assist with any protection activities needed to protect and recover these cave beetles. The KDFWR and TWRA both actively participated in gathering the information presented in Barr (1996, 1998) on the status of these species. It is anticipated that they will continue to support and participate in the rare cave beetle protection.

SUMMARY OF THREATS:

These six cave beetles are currently known from only a few/one cave(s). Their limited distributions make them vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction.

For species that are being removed from candidate status:

___ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5*
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10

		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: All of these six cave beetles are currently known from only one cave. Their limited distributions make them vulnerable to isolated events that would only have a minimal effect on the more wide-ranging members of the genus. Events such as toxic chemical spills, discharges of large amounts of polluted water, closure of entrances, alteration of entrances, or the creation of new entrances can have serious adverse impacts on these cave beetles and could result in their extinction.

Imminence: The treats faced by these species are significant, however, it is not anticipated that they will be subject to these threats in the immediate future (next 1-2 years).

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Given the current status and the magnitude and imminence of the threats to these species, emergency listing is not warranted at this time.

DESCRIPTION OF MONITORING

In fiscal year 2004, a cooperative agreement between the Kentucky State Nature Preserves Commission (KNSPC) and the Service funded a status survey of all formal candidate *Pseudanophthalmus* species in Kentucky. In 2005, KNSPC reported that there was no change in the status of the species and no new threats to their continued existence were identified during their surveys. In Tennessee, The Nature Conservancy has developed the Tennessee Cave Initiative with TWRA and others to identify and protect caves that support federally listed, candidate, and special concern cave dependent species. As a part of this initiative they regular monitor the sites that support these cave beetles and work to gain long term protection for them.

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: Tennessee and Kentucky

Indicate which State(s) did not provide any information or comments: N/A

LITERATURE CITED

Barr, Thomas C. 1959. New cave beetles (Carabidae, Trechini) from Tennessee and Kentucky. Journal Tennessee Academy of Science 34:5-30.

Barr, Thomas C. 1995. Kentucky Cave Beetles: Progress Report II. Unpublished Report to Kentucky Department of Fish and Wildlife Resources. Frankfort, Kentucky. 20 pp.

- Barr, Thomas C., 1996. Cave Beetle Status Survey and Prelisting Recovery Project. Unpublished Report to Kentucky Department of Fish and Wildlife Resources, Frankfort, Kentucky, and the U.S. Fish and Wildlife Service, Asheville, North Carolina. 63 pp.
- Barr, Thomas C. 1998. Study of Potentially Threatened or Endangered Species of Cave Beetles in Tennessee, Alabama and Georgia. Interim Progress Report to the Tennessee Wildlife Resources Commission. 11 pp.
- Barr, Thomas C. 2004. A Classification and Checklist of the Genus Pseudanophthalmus (Coleoptera: Carabidae: Trechinae) Virginia Museum of Natural History, Special Publication 11. 52 pp.
- Krekeler, C. H. 1973. Cave Beetles of the Genus Pseudanophthalmus (Coleoptera, Carabidae) from the Kentucky Bluegrass and Vicinity. *Feildiana* 62(4):35-83.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: /s/ Jeffrey M. Fleming 11/16/2005
Acting Regional Director, Fish and Wildlife Service Date



Concur: _____ August 23, 2006
Acting Director, Fish and Wildlife Service Date

Do Not Concur: _____
Director, Fish and Wildlife Service Date

Date of annual review: October 2005

Conducted by: Asheville, North Carolina Field Office